

2013 UDOT RESEARCH PROBLEM STATEMENT

*** Problem statement deadline is March 25, 2013. Submit statements to Steve Bagley at sbagley@utah.gov ***

Problem Title: Calibration of Automatic Performance Measures Speed and Volume Data **No. UT-13.03.17**

Submitted By: Mitsuru Saito and Grant G. Schultz

Organization: Brigham Young University

Email: msaito@byu.edu and gschultz@byu.edu

Phone: 801-422-6326 and 801-422-6332

UDOT Champion (suggested): Mark Taylor

Select a Subject Area

☐ Materials/Pavements

☐ Maintenance

☒ Traffic Mgmt/Safety

☐ Geotechnical

☐ Preconstruction

☐ Planning/Asset Mgmt

☐ Transportation Innovation

1. Describe the problem to be addressed.

The Utah Department of Transportation (UDOT) has been developing a system for realizing automatic performance measure evaluations using the rich information collection infrastructure for evaluating the performance of signalized intersections. UDOT is one of only two states using this approach to signalized performance measures and the only state that is utilizing radar equipment for this purpose. The Signal Performance Metrics system is the fruit of this effort for dynamic evaluation and collection of performance of signalized intersections. The system currently provides data summaries for five performance measures: 1) Purdue Coordination Diagram, 2) Speed, 3) Approach Volume, 4) Purdue Phase Termination Charts, and 5) Split Monitor. These performance measures provide signal engineers and others immediate access to the data, which in turn, allows them to respond quickly to traffic related problems and to collect traffic data for modeling, planning, and other traffic studies. Additional metrics, such as turning movement volume counts will be developed and available (website at <http://udottraffic.utah.gov/signalperformancemetrics/>) no later than the end of the 2013 fiscal year.

One unknown with the current system is the accuracy level of the speed and volume data that the system reports. For this system to be utilized most effectively, it is necessary that UDOT have a better understanding of the data accuracy and confidence level of the system. The purpose of this research is to conduct a study to calibrate speed and volume data reported by the Signal Performance Metrics system with ground truth data to determine its accuracy level and to develop calibration factors so that the users of the system have confidence in the use of this significantly informative system. In addition, the project will help to better define the 'sweet spot' for the signal detection, particularly with respect to the differing radar data collection systems. As turning movement volume counts become available, these data will also be calibrated as part of the project. This project will provide practical solutions with immediate benefits.

Note: The researchers will partner with Dr. Darcy Bullock at Purdue University on the project to ensure consistency with previous work. The researchers will coordinate with Wavetronix to ensure consistency with zone placement recommendations and previous work. Dr. Saito received his Ph.D. degree at Purdue University, knows Dr. Bullock well, and has contacted him about this effort, while Dr. Schultz has worked successfully in past projects with others at Wavetronix.

2. Describe why this research is important and how it is unique.

In addition to utilizing the automatic performance measures data internally, UDOT has made the Signal Performance Metrics system available to the public, university researchers, and engineering consultants. As a result, UDOT must have confidence in the information provided by the system. Currently, speed and volume data have not been calibrated (while turning movement volume counts have not yet been available) and hence the proposed study will provide UDOT with information on accuracy of the system so that the system's reliability is increased.

3. List the research objective(s) to be accomplished:

1. Set up a design of experiments for collecting ground truth data to calibrate speed and volume data.
2. Analyze ground truth data and compare these data with the data provided by the Signal Performance Metrics system.
3. Develop necessary calibration factors for converting reported speed and volume data to become closer to reality.

4. List the major tasks to accomplish the research objective(s):

1. Develop a project scope of work and detailed estimate.
2. Literature review on automated performance measure evaluation systems.
3. Selection of study sites.
4. Set up a design of experiments and consideration of factors to be considered (radar range, installation angles, etc.) and synchronize ground truth data collection and data collection by the Signal Performance Metrics system.
5. Set up data collection procedure (e.g., direct recording using the video recording system for recording live feed from UDOT cameras, manual counts, and/or using the Data Collection Trailer from the BYU Traffic Lab to collect volume and speed data).
6. Execute data collection plan.
7. Reduce speed and volume data (both ground truth data and data obtained by the Signal Performance Metrics system).
8. Analyze the data and summarize findings.
9. Report results to UDOT in the form of a written report.

5. List the deliverable(s) to come to UDOT from this research study:

1. Engineering report documenting the literature review and research results.
2. Calibration factors for speed and volume data reported by the Signal Performance Metrics system and its accuracy level.
3. Recommended placement of radar detection zones for speed and volume collection.

6. Describe how the results of this study will be implemented at UDOT.

UDOT will know the accuracy of speed and volume data provided by the Signal Performance Metrics system and will be able to provide the public with speed and volume (including turning movement data) reported by the system with confidence.

7. Estimated cost - Total: \$80,000-100,000 **UDOT Share:** \$80,000-100,000 **Other/Matching Funds:** \$

8. Outline the proposed schedule for this study, including estimated start date, duration, and major event dates.

It is recommended that this project begin summer of 2013 with the initial tasks of the project scope of work and detailed estimate, followed with the literature review. The work will continue according to the tasks outlined previously. It is anticipated that the project would take 12 months to complete.